

Mn/DOT Mileage-Based User Fee Demonstration Project

work plan

prepared for

Minnesota Department of Transportation

prepared by

Cambridge Systematics, Inc.

with

**MarketLine Research
GeoStats**

work plan

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Work Plan:

Mn/DOT Mileage-Based User Fees Demonstration Project

Since our draft memo on October 17, 2003 on proposed project approach, we have received comments from the project Advisory Committee, and have done further work advancing the approach and experiment design. This memo reflects those refinements, and represents our proposed approach. Responses to specific comments received are provided in Appendix A.

■ Project Objective

Quoting from our contract:

The objective of this project is to develop and conduct a pilot project that will test price elasticities of driving behavior by offering financial incentives and by simulating the replacement of fixed costs of ownership/leasing and operation with fees or charges based on mileage and perhaps time-of-day travel. The goals of this demonstration project are to:

- Simulate the replacement of the fixed costs of vehicle ownership and operation with variable costs that give drivers explicit price signals about travel decisions and alternatives;*
- Develop the best possible understanding of transportation price elasticities and how they vary by vehicle ownership/lease arrangement, income, location, annual mileage driven and other factors;*
- Develop an understanding about driver acceptance of use-based fees and appropriate price signals necessary to affect travel behavior changes; and*
- Identify strategies and recommendations that might be employed to “mainstream” or institutionalize policies or techniques learned from the demonstration.*

■ Overall Approach

The overall approach will be for the CS team to develop a simulation of a mileage-based automobile lease plus mileage-based insurance. We would pick up where the April focus groups left off, first ascertaining the market for such products, and then testing changes in driving behavior with a smaller “focus group” of study participants.

CS will first undertake a comprehensive market research effort to understand who would voluntarily opt for mileage-based leasing and/or insurance. This would build on the work done in the April focus groups, aiming for statistically relevant samples. The goal would be to understand the opportunities and constraints for real leasing or insurance products that might be offered by the private sector. We will not be evaluating programs that would be mandatory, such as conversion of registration fees or sales taxes to a mileage basis.

Using the general market research and other approaches, CS would recruit a small sample of people that might be willing to participate in our experiment. Most of the people would fit the profile of willing participants, though a portion would be those that say that they are not interested in the concept but would nonetheless be willing to participate in the experiment. We would simulate buying out the focus group participants’ leases and insurance, convert their payments to a fixed component and a variable component, set up a “budget” that they can draw down, and pay them the difference between budgeted miles and actual miles.

We would track the participants’ mileage for 10 months. Part of that time would be a control period, where they receive no feedback on miles driven. The other part would be an experiment period, where participants are provided price signals on a semimonthly basis. To enable us to account for seasonal effects, we will have different protocols of control and experiment periods described in further detail later in this work plan. In this way, the control groups can serve two purposes. First, they are a control for their own behavior. We will compare the behavior of each participant during their own control period to their own experiment period. The control participants also will serve as a separate control group to those that are in the experiment period in order to identify any general changes in regional driving behavior during the experiment period.

The control period and the experiment period will each be five months long. This period should be long enough to match seasonal variations between the control and experiment period, and still fit within the overall project timeframe (the project must be complete by September 30, 2005). Within the experimental period, we also will be able to test participant response to several variables, including total number of household vehicles, the number of vehicles included in the experiment, and variable pricing by time of day.

■ Approach to Specific Project Issues

In-Vehicle Technology

Data to fulfill the basic purpose of the simulation can be most cost-effectively by an in-vehicle device called Carchip. This is an off-the-shelf product that connects to a car's on-board diagnostic port (OBD II). This is the same port used by mechanics to get diagnostic readings. Although these devices do not have wireless transmission capabilities, they are easily swapped out by participants, and are inexpensive enough that we can have spares to allow time for a swap by mail. They also capture time-of-day data, which is an important part of the evaluation of the effectiveness of mileage-based fees at reducing peak-period congestion.

We looked at other solutions; however, they could not compete on the basis of price and readiness for use in this application. GeoStats (our technology subconsultant) estimated that the next best solution (the Benefon Trackbox) would require a minimum of six months of development time, with no guarantees that schedule could be met. The project schedule just cannot afford that delay, and risk of further delay. It should be noted that this approach will not permit capture of route choice data. That would require a far more expensive and time-consuming technology solution. Evaluated route choice was never a goal of this project, but is being tested in another FHWA project in the Seattle region.

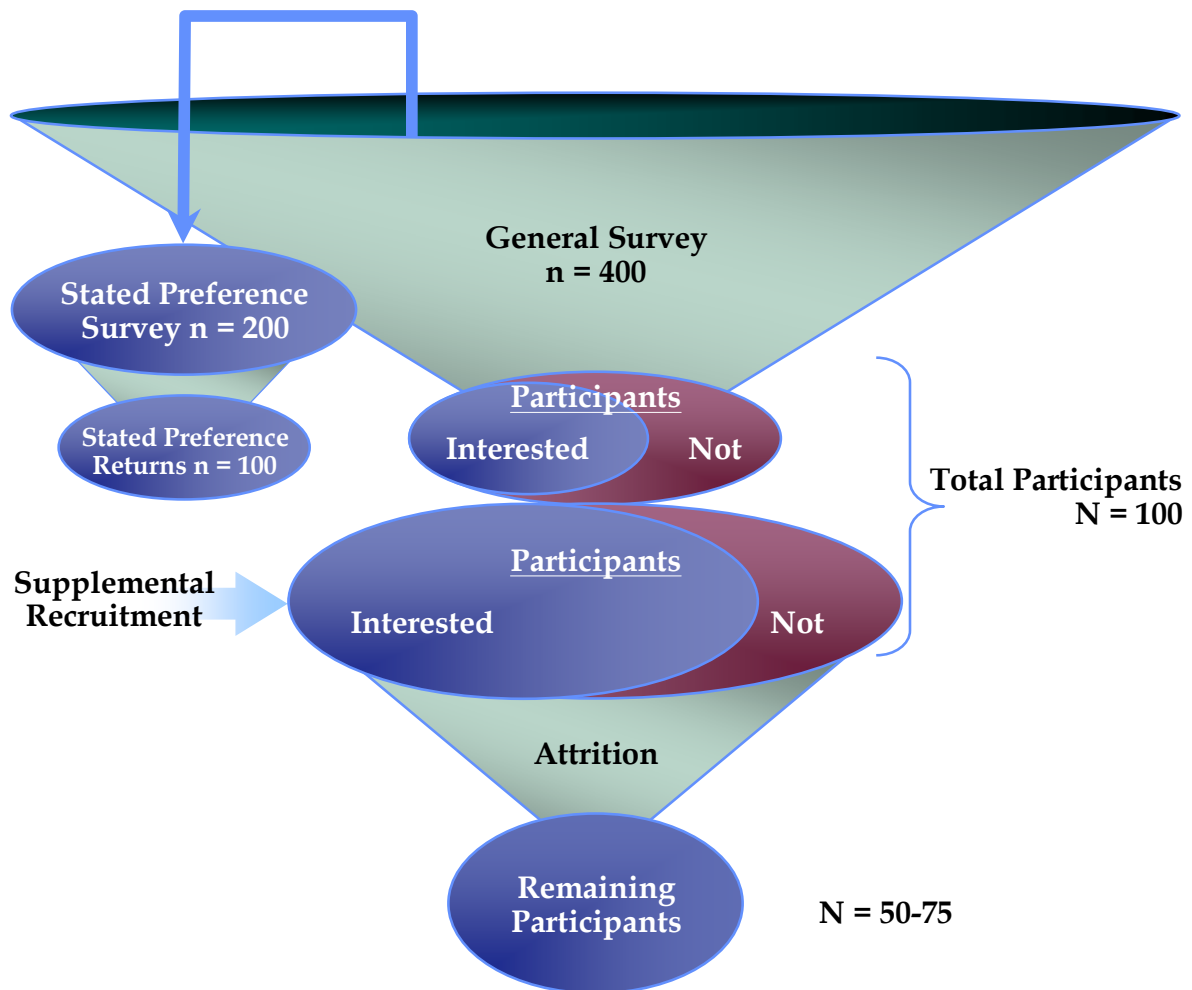
Market Research and Experiment Framework

The overall framework of the market research and experiment is shown in Figure 1. We are proposing a general survey of marketability of the mileage-based concept with a sample size of 400, which will provide statistically significant results. MarketLine (our market research subconsultant) will purchase a calling sample, which will enhance our ability to get a random sample.

The simulation will be with far fewer individuals. For the experiment, we have assumed that 100 participants would begin the experiment, but that we would be left with a minimum of only half (50 participants) at the end. We hope for a higher retention rate (say 75).

Issues of sample size and statistical significance were covered in detail in the previous memorandum. The discussion is reproduced in Appendix B.

Stated-Preference Surveys. Stated-preference surveys will give us a good baseline for understanding the choices that people will make related to opting in to a program with different program features and prices. Since the concepts in the stated-preference survey are complicated, these will have to be a mail-out/mail-back survey instrument, though it does not have to be long. We propose to ask each of the 400 respondents to the general survey whether they would be willing to do an additional survey. We expect half to say yes, and half of those to return the survey, yielding 100 stated-preference responses.

Figure 1. Market Research and Experiment Framework

Recruiting for the Experiment. Our challenge is to find a cost-effective way to recruit participants for the experiment. We are most interested in people who would “opt in” to a mileage-based program; however we also would like a sampling of people who say they are not interested, because in the real world, some of these people may ultimately change their mind. We can learn something by tracking how their attitudes change over the course of the experiment.

We propose a two-step recruiting strategy. First, we will recruit from the 400 households that participate in the telephone survey. Based on what we heard at the focus groups, we estimate that about 10 percent of the people we interview might be interested in a mileage-based fee product if it existed. We further estimate that half of those people would participate in our experiment, assuming we give them a reasonable monetary incentive. Five percent of the population of 400 individuals would yield 20 participants. We also would recruit a few individuals that state that they are not interested in the program.

People that are interested (and that pass the screening criteria) would be mailed information describing the proposed experiment as well as a short stated-preference survey, with a follow-up call from a MarketLine recruiter. The stated-preference survey would be the same as the one sent to the other respondents.

In our previous memo, we described two ways to recruit the additional participants:

1. Option A: Telephone recruit; and
2. Option B: Advertising recruit.

Each had advantages and disadvantages, related to complexity, cost, and ability to get a representative sample. We recommended the advertising approach. Details of our explanation are reproduced in Appendix C.

In the meantime, MarketLine has suggested another approach that we believe is the best. That is to use an Internet Panel provided by Harris Interactive Service Bureau. Harris' Internet Panel is a list of people that have agreed to participate in surveys over the Internet on a periodic basis. In return, they are eligible for awards through drawings. The panel has 31,000 members in the Twin Cities, and is representative of the general population. Details on the Panel are provided in Appendix D.

All 31,000 panel members of Harris Interactive Service Bureau would be sent a screening survey over the Internet to determine if they would qualify to participate in the study. Qualified respondents would be asked if they would be willing to participate in additional surveys and experiments for compensation. Harris Interactive could provide their telephone number to MarketLine. Respondents who agree would be contacted by MarketLine and sent the same materials as those recruited from the general market research survey – the stated-preference survey and the instructions.

The Internet Panel has these advantages:

- No “needle in the haystack” syndrome. These are people that we know want to participate in research. They also are less likely to drop out.
- Up-front demographic information.
- Broad-based sample.

Research Procedure

Once participants are recruited we will split them into groups according to whether they are experiment or control at the beginning of the simulation.

A technician will be sent to participants' homes to install the Carchip, and show them how to swap them. They will be instructed to direct further questions to us. GeoStats has an 800-number set up to handle such calls.

For those in the experiment period, the pricing framework will be communicated (e-mail or mail) after the Carchip is successfully installed.

MarketLine will call each participant after two weeks to make sure everything is going all right.

GeoStats will mail replacement Carchips to each respondent on a monthly cycle (for those in the control period) and on a semimonthly cycle (for those in the experiment period).

During the course of the simulation period, we will change the experiment/control basis in accord with the experiment design (see more details in the *Experiment Design* subsection. About midway through the 10-month period, we will survey all participants on their attitudes towards the mileage-based leasing concept.

At the end of the second period, we will have an exit survey, exploring attitudes once again. We also will repeat the stated-preference work.

Incentive Amounts

We want to offer the smallest incentive possible (to save money) consistent with having a payment large enough to actually incentivize people to join and stay with the program. We do not know with certainty how much this incentive will need to be, but suggest \$100 as a reasonable amount. In addition to the \$100, each participant also will have the opportunity to earn more money based on their actual mileage during the experimental period.

We propose paying out the incentives on the following schedule:

- \$25 upon swapping the first Carchip, and responding to the first phone interview (about five minutes).
- \$25 upon completing the first experiment period, i.e., at the time we institute or change the pricing procedure.
- \$25 after responding to the mid-experiment period interview.
- \$25 upon completion of the experiment period, and responding to a closeout interview (about 15 minutes).

Which Vehicles to Instrument?

We want to understand the extent to which participants respond to pricing by switching travel from a priced vehicle to a non-priced vehicle. This is important because a real-world product would be one where people have this opportunity. Therefore, it is desirable that all vehicles in a household be instrumented so that we can easily track these

shifts. We have assumed that an average of two vehicles per household will be monitored.

Most of the participants will have only one vehicle priced. A few will have all vehicles priced, so we can gain a sense of the difference in response. We also can try different pricing mechanisms on the same household. We fully expect that some participants will shift mileage from the priced to the non-priced vehicle. A commercial vendor of a pricing product would not care that this happens – in fact, they would expect it. However, from a public policy perspective, it is important to understand the extent to which such products only result in mileage shifting among household vehicles, as opposed to reductions in overall household driving.

Sizing the Mileage Fees and Mileage Budget

The work we did with General Motors and during the focus groups provides some insight into this. For a typical midsize car, the variable component of the mileage-based lease was estimated to vary between 10 and 15 cents per mile. Typical insurance would add another 2 to 10 cents per mile.

There are two concepts related to the fees that we want consider:

1. Convert existing leases (or the lease that someone would have with a specific kind of vehicle) plus insurance to a mileage basis, by dividing the annual lease cost by the annual mileage allowance under the lease. This would replicate a straight conversion of lease from fixed to mileage basis, however has no relationship to people's current driving habits
2. Take the participant's annual lease plus insurance cost (or lease cost for that kind of vehicle) and divide by the participant's actual mileage for the selected vehicle from the previous year. This would set the cost that would result in the participant breaking even if they maintained their driving habits.

There are two elements of the study that relate to specific prices. First, we will be doing stated-preference experiments with the general survey participants to gauge the level of interest in the mileage-based fee program. Second, we need to set prices for the experiments themselves.

For the stated-preference survey, we plan to use pricing that matches reasonable prices that might be offered by a private company leasing a car. We will base the prices on the make and model (or price range) of the next car the respondent plans to buy. We will develop a model that takes into account price, as well as expected depreciation profile (e.g., a Toyota Camry may depreciate slower than a Dodge Neon). We will identify both the fixed and variable components of the cost.

For the experiment, we are more interested in finding elasticity values for the per-mile prices that would be in the realm of reasonableness for the person's current vehicle. We also want to take into account their actual driving behavior, and set the prices such that no

change in behavior will result in zero dollars left in their mileage budget. We are developing a model based on past driving behavior as well as current auto to set mileage budgets and per-mile rates to use. The model will consider that we need to test a range of rates.

To protect ourselves from someone who tries to game the system by putting their car in their garage for six months and not driving at all, we will limit the potential payout to a 25 percent reduction in driving.

Survey Experiment Design

Since we expect that people's responses to the experiment will include changes in vehicle miles traveled and substitution between household vehicles, we want to ensure we have a mix of respondents among a few different categories:

- Number of vehicles (one, two, or three vehicles);
- Mileage level per vehicle (lower than median annual miles, higher than median annual miles);
- Number of vehicles compared to number of licensed drivers (more drivers than vehicles, the same or fewer drivers than vehicles).

We had developed a recruitment plan to obtain households of each combination of categories, but it will be difficult or impossible to obtain households in every possible combination of these variables. Therefore, our proposed recruitment targets for the 100 participating households are:

- At least 30 one vehicle households;
 - At least 10 low mileage one vehicle households
 - At least 10 high mileage one vehicle households
- At least 30 two vehicle households;
 - At least eight two-vehicle households with low mileage on both vehicles
 - At least eight two-vehicle households with high mileage on both vehicles
- At least 30 three or more vehicle households;
 - At least eight three-vehicle households with two or three low-mileage vehicles
 - At least eight three-vehicle households with one low-mileage vehicle
- At least 40 households with more drivers than vehicles; and
- At least 40 households with the same or fewer drivers than vehicles.

Note that some categories will probably be harder to fill in than others, so we may need to adjust the targets. For the specific cross tabulation of drivers and vehicles, we could get a distribution from the MetCouncil Travel Behavior Inventory and/or use 2000 Census Transportation Planning Package data to get “actual” distributions and to determine whether we have made any difficult quota groups.

For the different combinations of vehicles and mileage levels, we would offer different experiments:

- Some households would be asked to include all their vehicles in the per-mile pricing;
- Some households would be allowed to choose one of their vehicles to be priced per mile; and
- Some households would be asked to include one pre-assigned, randomly chosen vehicle to be priced per mile.

All household vehicles will have their mileage tracked throughout the 10-month period.

To enable us to account for seasonal effects, participants will go through the experiment in four different ways:

- Some households will go through a five-month control period, followed by a five-month single mileage price experiment;
- Some households will begin with a five-month single mileage price experiment, followed by a five-month control period;
- Some households will begin with a three-month control period, then a four-month single mileage price experiment, then a three-month time-of-day pricing experiment;
- Some households will begin with a four-month single mileage price experiment, then have a three-month control period, and then a three-month time-of-day pricing experiment; and
- Some households will begin with a four-month single mileage price experiment, then have a three-month time-of-day pricing experiment, and then have a three-month control period.

Where possible, we will assign similar households to different experimental regimes (timing of control and experiment phases, treatment of household vehicles. The assignment of households will occur once the recruitment is completed.

■ Detailed Work Plan

Details of our proposed work plan are provided below.

1. Planning Design and Management

- Develop a revised work plan
- Develop market assessment survey instrument
 - Anticipate two rounds of review with Mn/DOT and FHWA staff
- Develop technology solutions and data harvesting methods. Includes:
 - Software development to extract data from Carchips.
 - Software development to generate participant statements of travel activity and associated budgets / balances. These statements will be available by web site access, e-mail distribution, and/or regular mail.
 - Software development to generate database for pricing simulation analyses.
- Prepare monthly progress reports
- Steering committee meetings and conference calls (for budget purposes, identified in individual work tasks below)

2. Market Survey and Initial Recruiting

- Carry out general market survey and experiment recruit screening
 - 400 interviews to obtain random sample
 - Purchase a calling sample
 - Respondent qualifications:
 - Resident of the metro area for at least six months
 - Valid drivers license
 - Have driven on state highways or freeways in the past month
 - Assume a 15-minute interview, with four open ended questions
- Respondents that are low mileage (<100 miles per week) or have no cars will be surveyed; however their survey will be an abbreviated version.
- Qualified respondents will be invited to participate in experiment.
 - Qualifications: as for survey, above, plus
 - Minimum of 100 miles driving per week.

- One, two or three vehicles in household
- 1996 or newer cars in household
- No plans to acquire a vehicle in the next year
- Expect 20 recruits from the general survey;
- All respondents will be asked if they would be willing to participate in a mailed-out stated-preference survey;
- Assume half say yes. Assume half of these respond;
 - This will generate 100 stated-preference responses (some of which will be those in the experiment)
- Analyze general market survey; and
- Prepare tabulations, cross tabulations, and a technical memorandum.

3. Technology Development and Testing

- Field test technology and data harvesting with five test households in Twin Cities region.
 - Technician will install Carchip and instruct participant how to swap Carchips.
 - GeoStats will test Carchip swapping procedures, data downloading and analysis, and preparation of simulated invoices.

4. First Field Experiment Period

- First wave of recruits
 - Communicate with recruits from the Market Survey; mail out these materials:
 - Instructions for what the experiment is all about; tell them to expect a visit from the installer. We will not have the prices at this time. That will be in a subsequent communication.
 - Stated-preference survey. The survey is a required part of the deal that gets them their incentives.
 - Calculate mileage fees of selected recruits.
 - Communicate fees to participants (for those doing the experiment period first).
 - Install Carchip in first wave of participants. To be done by a technician, who will instruct the participant how to swap the Carchip and mail it back
 - Mail out first Carchip swap

- Download first Carchip wave and evaluate data quality
- Adjust procedures as needed
- For those in a priced period, transmit first simulated invoice. Most via e-mail.
- Check-in survey of first wave to make sure everything is going OK. Assume five-minute duration.
- Second wave: Recruit additional participants through Internet recruit method:
 - Develop screening survey to be administered over the Internet to Panel members of Harris Interactive Service Bureau. Survey will ask if OK to provide phone number to MarketLine for additional surveying/experiments.
 - Review survey responses, and identify those that fit characteristics we desire.
 - MarketLine calls qualified people that agree to provide their phone number to recruit them.
 - Communicate with recruits from the Internet Panel:
 - Mail out materials:
 - ▶ Instructions for what the experiment is all about; tell them to expect a visit from the installer. We will not have the prices at this time. That will be in a subsequent communication.
 - ▶ Stated-preference survey. The survey is a required part of the deal that gets them their incentives.
 - Calculate mileage fees of selected recruits
 - Communicate fees to participants (for those doing the experiment period first).
 - Install Carchip in second wave of participants. To be done by a technician, who will instruct the participant how to swap the Carchip and mail it back
 - Mail out first Carchip swap
 - Download first Carchip wave and evaluate data quality
 - Adjust procedures as needed
 - For those in pricing period, transmit first simulated invoice. Most via e-mail.
 - Check-in survey of second wave to make sure everything is going OK. Assume five-minute duration.
 - Repetitive Activities:
 - Mail out Carchips for swap
 - ▶ Monthly for those in control period
 - ▶ Semimonthly for those in experiment period

- Download Carchip data into database
- Evaluate data for anomalies and concerns
- Transmit simulated mileage statement of account for those in experiment period, on a semimonthly basis
- Respond to participant inquiries

5. Subsequent Field Experiment Periods

- Mail instructions to participants regarding the changes in rules (control to experiment and vice versa).
- Call participants to make sure they understand the rules
- Continue to perform carchip swaps and send mileage statements

6. Surveys

- Mid-Experiment Survey
 - Ask attitudinal and stated-preference questions again
 - 15 minutes
 - Analyze survey
- Closeout Survey
 - Ask attitudinal and stated-preference questions again
 - 15 minutes
 - Analyze survey

7. Analysis

- Analyze data
- Draft Final Report
- Steering Committee Meeting
- Final report

Appendix A

Response to Advisory Committee Comments

■ Questions on Project Objective

1. **If there is no congestion-based element, what is the connection to the value pricing program?**

The study, at its core, is about the effect of mileage-based user fees on people's travel behavior. Over the course of the study, we have clarified the intent to consider actual products that the private sector might offer on a voluntary basis, rather than a mandatory program that converts registration (or other government) fees. Considering this, private sector leasing companies would have little incentive for products based on time of day.

Of course, what Mn/DOT cares the most about is reduction in travel during peak periods. The Carchip technology will enable us to track time-of-day data which may provide some insight on this. It also may be possible to test the impact of peak/off-peak pricing in some of the experiments that we carry out. In this case, the connection to a real leasing product is tenuous, however there may be some rational connection to a mileage/time-of-day-based insurance product.

2. **If car makers already have looked at this idea and passed, then why are we spending taxpayer money to study it for them?**

The advisory committee was enthusiastic about getting a real private sector partner involved, as were we. We had a previous connection with General Motors, and took advantage of that to get our foot in the door, and get them to participate to the extent they did. At the same time we talked to General Motors, we also had discussions with Enterprise Rent A Car and Flexcar, both of whom also turned us down.

When GM turned us down, we had two potential avenues: 1) expend additional project resources to court other private sector companies that might participate, or 2) do a simulation.

It was our recommendation, and the Advisory Committee agreed, that spending additional resources on simply finding another partner would use up too much of the project budget, and still not necessarily be successful. Therefore, we are moving forward with the simulation.

Just because this didn't succeed doesn't mean there is not now or never would be private sector interest in the concept. A legitimate role of government is to serve as a catalyst for private sector investment by demonstrating proof of concept for ideas which may be premature or overly risky for the marketplace to test on its own.

3. **The document states that about 10 percent of people already talked to were interested in principle in mileage-based pricing. That sounds about right. If we pick ONLY those people, does it mean anything if ALL OF THEM are affected by price. I suppose something is learned but the really interesting question is what share of ALL PEOPLE would change behavior (we only need 10-15 percent based on London). Again, what exactly are we testing? And what kind of conclusions can we make if all works well? Or are we just testing the technology?**

First of all, the 10 percent number is a guesstimate based on what we heard at the focus groups. We will be statistically quantifying that number in the general survey.

Conceptually, we are most interested in how people who would in reality choose a mileage-based pricing product will react to the pricing. These people should be the focus of the experimental portion of the project. We can then use the general survey to project the impact of these changes on the general population and general driving behavior.

In reality, some of those who say they are not interested when surveyed may indeed become interested after friends try the product and like it. We therefore want to have some portion of the experimental universe include those who say they are not interested.

4. **If we price only one vehicle while monitoring both, the concern is the program will be charged with wasting Federal government money to pay people to make changes in their driving habits.**

We are trying to simulate a real product. That real product would be one that customers would opt in to. In many (perhaps most) cases, the customer would have only one car in their household priced in this way. Therefore, it makes sense to understand any car-shifting that might happen.

We plan to design the experiment such that some of the households have all vehicles subject to pricing, while others have only one.

5. **We did not receive a copy of the budget listed at the top of the document. Without a budget, it is difficult to provide suggestions that will not cause additional strain on the remaining project funds.**

Sorry. This was a draft memo that was circulated prior to being finalized. The budget that reflects the most recent concepts will be attached to the revision of the memo.

6. **We should determine now whether or not they intend to evaluate the mileage-based insurance portion of the project.**

Yes. We would like to get the size of the mileage-based fees up as high as possible, so want to include insurance in the amounts.

7. The team should be prepared for media attention.

It would be appropriate to do some proactive work with area newspapers and media outlets to explain the purpose of the project. If we don't go the advertising route with the additional recruits, this may not be necessary.

■ Questions on Experiment Design

8. Moving forward on the basis of 50-75 participants (as a maximum, if I read this correctly) still seems to mean that it is very unlikely that much can be learned in terms of any kind of statistical test. And since there is now no attempt at getting any kind of representative sample, I'm not sure what we will actually be testing.

We have sized the experiment to allow statistically valid results to result from the experiment. The experiment design will stratify the population further to make sure we get a representative sample. Our work plan memo had a discussion on the statistical issues that is reproduced in this document as Appendix B. We would be happy to discuss the particulars of your concerns.

9. Relax the requirement to have three-year and newer cars.

We have been talking about this ourselves, and agree that it makes sense to relax this requirement. Our only constraint is that cars must be 1996 model year or newer, as earlier models do not necessarily have OBD II ports.

10. The current version of the experimental design is difficult to grasp. A set of PowerPoint slides would be useful to clarify whether the control or experimental treatment is applied when and to whom.

We have refined the experiment design in this work plan, along with illustrations.

11. Can we net out long-distance travel outside of the metro area?

Ideally, we would like to do this, however we are constrained by our technology. Also, such pricing would not be relevant to a real-world product that the private sector might develop.

12. Do we provide feedback biweekly or whatever but just make one lump-sum payment at the end? Or do we actually pay them biweekly, given that much of the observed reductions in travel might just be accidental? The former would give a way of recovering costs for the periods that they go over budget, and would stop small-scale "gaming."

Our thinking is that the participants will get feedback on a semimonthly basis in the way of statements. They would not get to keep their money until the end.

Also, their accounts will not reset at the end of each period. In essence, they will have a travel budget for the entire period. This is different from cell phone plans that have 200 minutes per month, “use them or lose them.” This mirrors the reality of a likely product, where the lessor will charge you miles on a monthly basis, with no floor or ceiling.

13. **I’m a little confused how the simulation works. If half the group starts as an experiment (the other half is a control), how do I reward person 1 if I don’t know what their “base miles driven” is? Do I wait for 10 months and then say, you only drove 700 miles a month in the first five months and 800 miles a month in the second five months, so I now “owe” you 100 miles a month? It seems hard to figure out how to get the incentives right in the first group (the control then experiment is easy).**

We will develop their base miles from their stated odometer readings when they obtained the car and today, and the number of months in between.

14. **I’m not sure I followed how the actual pricing would work, especially with respect to owned vehicles. How exactly would the price be set and what payments would be made, and based on what?**

This is a critical question that our team has been evaluating. There are tradeoffs involved. Ideally, we would simulate the exact car the people have now, and convert the current costs to mileage-based costs of ownership and insurance, and consider the fixed and variable costs.

However, this is less effective at getting us to understand price elasticities. For this objective, we want to be able to vary the costs, and also make sure that the pricing experiment does not cause the participant to “give up” prematurely. We therefore want to understand people’s past mileage history, and price the miles and their mileage budget such that if they don’t modify their driving, they come out the same as they would have been otherwise. We will need some flexibility in setting these prices to enable us to effectively derive price elasticities from the data.

Further details are provided in the revised work plan.

15. **It would be helpful to get the consultant’s assessment of the risks of failure using recruit options A versus B (would, for example, newspaper recruitment be riskier than telephone recruitment?)**

There are pros and cons of each approach. We believe that the telephone recruit will provide a higher quality (i.e., more representative) population, however it is akin to finding a needle in a haystack. It also is considerably more expensive than the newspaper route.

We believe the newspaper route will give a reasonable response, however has some element of self-selection bias.

Since developing the last work plan, our market research subconsultant MarketLine has suggested a third alternative. That is to recruit from what is known as an Internet panel. Under this concept, we would engage a company that specializes in finding people

willing to fill out surveys and participate in market research testing. These people already are categorized by demographic characteristics. Panel members will be invited to participate in the survey according to the characteristics quotas that we are looking for.

With this method, we can be more selective of study participants based on driving behavior, and our outreach is much less hit-or-miss.

Further details are in the work plan.

16. **Regarding “Incentive Amounts,” we may want to consider reducing this, which might not only save a bit of budget, but also help ensure recruiting those who are not more interested in the participant payment than the potential to opt into a mileage-based program.**

There is a tradeoff here. Higher incentives encourage people to stay with the experiment and increase sample size. We want the lowest incentive amount that will get us our 50-75 participants that stay with us through the whole experiment. There is no way to guarantee what this rate is – we are relying on our judgment and that of our team to set the incentive correctly.

17. **While the budget implications of Carchip versus the Benefon Trackbox were discussed, a more detailed discussion would be appropriate about the range of advantages and disadvantages of each.**

The biggest factor in our recommendation to move forward with the Carchip is that the Carchip can be rolled out into this demonstration with minimal customization and software development. We estimate that the Benefon product would involve at least six months of development time, which also has budget implications. Beyond the budget, though, the schedule implications are more serious, since this project has a fixed end date.

18. **Under “Recruiting Issues,” we should try to get a reasonable cross-section of the population that would choose to opt into a mileage-based program**

That is our intent. See also discussion under Question 3 and Question 15.

Appendix B

Details on Issues of Statistical Significance

We are proposing a general survey of marketability of the mileage-based concept, where we expect the sample to be in the 400-500 range. The simulation will be with far fewer individuals, with the question being: how many participants do we really need to get anything of statistical value? As always with sample size questions, the answer is more is better. Resource and time constraints push us to lower sample sizes.

If we take the most simple type of statistical question, the population proportion of a random sample, in which you want to say with some confidence what the percentage of a population is that fits a category (e.g., percent of people who would vote for Howard Dean, percent of M&M's in a bag that are blue, percent of people who would be very interested in mileage-based user fees, percent of Vikings fans wearing silly hats, etc.), we can see the effects of sample size.

First, we select the confidence level we want to apply for the experiment. Then, for different sample sizes, we can measure the confidence limits. A confidence level of 95 percent is commonly used. At this level, if we obtain a random sample of 384 participants, we can calculate that our confidence limits will be no more than plus or minus five percent.

The interpretation of this is that 95 times out of a 100 if you randomly draw 384 participants from a large population and find out if they fit the category you are interested in, you will be able to say that your proportion estimate is within plus or minus five percent of the actual population proportion. Similarly,

- If you draw 200 participants and test them, you will be able to say you're 95 percent confident that your estimate is within plus or minus 6.9 percent of the actual percentage.
- If you draw 100 participants and test them, you will be able to say you're 95 percent confident that your estimate is within plus or minus 9.8 percent of the actual percentage.
- If you draw 50 participants and test them, you will be able to say you're 95 percent confident that your estimate is within plus or minus 13.9 percent of the actual percentage.

- If you draw 30 participants and test them, you will be able to say you're 95 percent confident that your estimate is within plus or minus 17.9 percent of the actual percentage.

The limits are too large for smaller sample sizes to provide useful conclusions.

The good news, though, is that many of the analyses that we will want to perform from the experiment data (paired t-tests, chi-squared tests) are more forgiving in terms of sample size. We performed some simulations to measure the effect of sample size on the comparison of control and experiment data. We randomly generated a synthetic population of observations representing user-fee-affected and non-user-fee-affected trip/mileage rates. Then, we drew samples from these populations to see whether we will be able to state with a level of statistical significance that a change in trip making has occurred. We varied both the differences (means and variances) in the underlying population (which will be unknown to us in the actual experiment) and the sample sizes drawn. We then performed two-tailed t-tests to determine whether a statistical difference could be detected with that sample.

While the use of simulated datasets is fraught with assumptions and simplifications, we can at least get a feel for the effect of different sample sizes. We did our tests over a range of assumptions about the underlying population and the actual differences between with- and without-user fee travel. We looked at underlying true trip rate reductions over a range of mileage-reduction percentages between 0 and 20 percent and a range of sample sizes from 30 to 100.

Based on the simulations, our ability to correctly measure a statistically significant difference between the two populations is pretty marginal with a sample size of 30. Moving from 30 to 40 increases the likelihood that we will correctly detect an actual difference by about 15 percent. Going from 40 to 50 sample units improved our ability to measure an actual difference by 30 percent, and going from 50 to 75 increases the likelihood that we will detect a measurable difference by another 30 percent. Based on the assumptions we tested, we get only a marginal improvement beyond a sample size of 75.

Our conclusion based on our oversimplified analysis is that we should strive to get to a sample size in the 50 to 75 range if at all possible. Sample sizes larger than this would allow us to analyze subpopulations more effectively, but may not be necessary for drawing conclusions about the overall population.

Based on these analyses, we are assuming a market research sample size of 400, which will generate statistically significant results. For the experiment, we have assumed that 100 participants would begin the experiment with us, but that we would be left with only half (50 participants) at the end. A higher level of retention will give us better data.

Appendix C

Description of Telephone and Newspaper Recruit Options

Option A – Telephone Recruit. Under this approach, we will use information from the Market Assessment Survey to help target potential respondents. The screener questionnaire will be adopted from the broader market survey, but participants will not answer the full array of questions. As with the broad market survey, this approach would use a phone-mail-phone technique. If we assume that 10 percent of the people called are interested in the mileage-based concept, and half of those interested will participate, we will need to call 1,600 people to recruit 80 experiment participants. The cost of this approach is estimated at \$42,000.

Option B – Newspaper Recruit. Under this approach, we will place advertisements in the Minneapolis Star Tribune and the St. Paul Pioneer Press. We will place two ads per week for two weeks (eight ads total), asking people that meet certain qualifications to call MarketLine. We estimate 50 responses per ad for a total of 400 responses. A 25 percent qualification rate would yield 100 participants (we will need 80). The cost of this approach is estimated at \$24,900.

We recommend the Option B, Newspaper Recruit. First of all, it's less expensive. Second of all, it's simply easier and quicker to allow the interested population to identify itself, rather than conducting a needle in the haystack search.

The two-part recruiting framework leads us to work with two waves of participants. The first wave would be with those recruited from the market survey, and the second wave would be those recruited with the advertisements. This gives us the opportunity to adjust techniques as appropriate after the smaller first wave is underway.

Appendix D

Harris Interactive Panel Details

MarketLine has investigated the possibility of using an Internet panel as an alternative methodology to recruit participants for the Mileage-Based User Fee Study.

■ Overview of Recruiting Process

Panel members of Harris Interactive Service Bureau would be sent a screening survey to determine if they would qualify to participate in the study. This would be the same survey that is used in Option A – Telephone Recruit and Option B Newspaper Recruit. Qualified respondents would be asked if Harris Interactive could provide their telephone number to MarketLine. Respondents who agree would be contacted by MarketLine and sent materials as proposed in the task “Recruit Survey – Wave 1.”

Respondents who agree to participate would follow the same testing process as proposed.

■ Description of Harris Interactive Panel Members

Harris Interactive has about 31,000 panel members in Mn/DOT’s traditional eight-metro county area:

Anoka	Carver	Dakota	Chisago
Hennepin	Ramsey	Scott	Washington

A count of panel members by gender and age is shown in the attached. Panel members invited to participate in the survey can be selected by demographic characteristics to ensure that they represent a representative sample of residents. However, this does not mean a representative sample will respond to the survey. Potential participants would be selected from those who respond and qualify to have a representative sample of desired characteristics to participate MBUF study participants.

The demographic questions that Harris Interactive uses to classify panel members are provided at the end of this appendix. These characteristics can be used to select panel

members who would be sent a screening survey. Census 2000 information also is included to compare panel demographics to county demographics.

■ Potential Number of Participants

The calculations to determine the number of potential participants is shown below.

Number of panel members in eight-county metro area	31,000
10% are expected to respond to the screening survey	3,100
Expected incidence:	
10%	310
15%	465
50% acceptance	
10% incidence	155
15% incidence	232

Note: These numbers are somewhat optimistic because all panel members who qualify may not be willing to allow Harris Interactive to provide their telephone number to MarketLine Research.

Using this methodology has the potential of providing more participants than currently planned and budgeted for. This would allow the opportunity to be more selective of study participants based on driving behavior and/or indicated interest in the study. This methodology also has the added benefit of identifying a larger pool to replace any participants dropping out during early phases of the study.

■ Harris Interactive Standard Demographic Questions Demographics Available for Selection of Potential Participants

Are you...?

1. Male
2. Female

In what year were you born? <I>Please enter as a four-digit number, e.g., 1963.</I>
[RANGE: 1890-1999]

In which country or region do you currently reside?

In what state or territory do you currently reside?

What is your zip code?

Excluding e-mail, how many hours per week do you spend on the Internet or World Wide Web?

What is your marital status?

1. Single, never married
2. Married
3. Divorced
4. Separated
5. Widowed
6. Living with partner

“Including you, how many adults (age 18 or over) live in your household?”] INSERT
“How many adults (age 18 or over) live in your household? *If you live in more than one household, please answer for only one of the households.*]
[RANGE: 1-50]

Q206 [IF AGE 18 OR OVER (Q106/03-13) OR IF AGE IS UNKNOWN (Q106/99)
INSERT “How many children under the age of 18 live in your household?”] [IF AGE 17
OR YOUNGER (Q106/01,02) INSERT “Including yourself, how many children under the
age of 18 live in your household?” *If you live in more than one household, please answer for
only one of the households.*
[RANGE: 0-15]

Q210 What is your employment status? *Please check all that apply.*
[MULTIPLE RESPONSE] [NOTE: CANNOT CHOOSE 4 AND 1, 2, 3, OR 5;
OR 5 AND 1, 2, 3, OR 4.]

- 1 Employed full-time
- 2 Employed part-time
- 3 Self-EMPLOYED
- 4 Not employed, but looking for work
- 5 Not employed and not looking for work
- 6 Retired
- 8 Student
- 9 Homemaker

Q1025(15) What is the highest level of education you have completed or the highest degree you have received?

1. Less than high school
2. Completed some high school
3. High school graduate or equivalent (e.g., GED)
4. Completed some college, but no degree
5. Associate's degree
6. College graduate (e.g., B.A., A.B., B.S.)
7. Completed some graduate school, but no degree
8. Completed graduate school (e.g., M.S., M.D., Ph.D.)

Q1026(19) Which of the following income categories best describes your total 2002 household income before taxes?

- 01 Less than \$15,000
- 02 \$15,000 to \$24,999
- 03 \$25,000 to \$34,999
- 04 \$35,000 to \$49,999
- 05 \$50,000 to \$74,999
- 06 \$75,000 to \$99,999
- 07 \$100,000 to \$124,999
- 08 \$125,000 to \$149,999
- 09 \$150,000 to \$199,999
10. \$200,000 to \$249,999
11. \$250,000 or more
12. Decline to answer

Q1028(21) Are you of Hispanic origin, such as Latin American, Mexican, Puerto Rican, or Cuban?

- 1 Yes, of Hispanic origin
- 2 No, not of Hispanic origin
- 9 Decline to answer

Q1030(20) Do you consider yourself...?

- 01 White
- 02 Black
- 03 Asian or Pacific Islander
- 04 Native American or Alaskan native
- 05 Mixed racial background
- 06 Other race
- 08 African American
- 09 First Nation/Native Canadian
- 10 South Asian
- 12 Chinese
- 13 Korean
- 14 Japanese
- 15 Other Southeast Asian
- 16 Filipino

17 Arab/West Asian

94 Decline to answer

Q1036 Please specify what race you consider yourself.**Q1040** You indicated that you consider yourself of a mixed racial background. With which of the following racial groups do you most closely identify? *Please select all that apply.*

[MULTIPLE RESPONSE]

- 01 White
- 02 Black
- 03 African American
- 04 Asian or Pacific Islander
- 05 Native American or Alaskan native
- 06 Other race
- 07 Decline to answer

■ Harris Interactive Demographic Profile

County	Gender	Age	Harris Interactive		Census 2000 Data	
			Percent in		Percent in	
			County	All 8-Counties	County	All 8-Counties
Anoka	Female	18-30	32%		18-29	14%
Anoka	Female	31-40	21%		30-39	18%
Anoka	Female	41-50	19%		40-49	16%
Anoka	Female	51-60	12%		50-59	11%
Anoka	Female	Over 60	4%		60+	11%
Anoka	Female	Under 18	11%		under 18	28%
Anoka	Female	Unknown	1%			
Percent of Females in all 8-counties				10%		11%
Anoka	Male	18-30	31%		18-29	16%
Anoka	Male	31-40	20%		30-39	18%
Anoka	Male	41-50	20%		40-49	17%
Anoka	Male	51-60	16%		50-59	11%
Anoka	Male	Over 60	5%		60+	9%
Anoka	Male	Under 18	8%		under 18	29%
Anoka	Male	Unknown	1%			
Percent of Males in all 8-counties				8%		11%
Carver	Female	18-30	57%		18-29	12%
Carver	Female	31-40	12%		30-39	20%
Carver	Female	41-50	7%		40-49	17%
Carver	Female	51-60	3%		50-59	9%
Carver	Female	Over 60	1%		60+	11%
Carver	Female	Under 18	20%		under 18	31%

Carver	Female	Unknown	0%			
Percent of Females in all 8-counties				7%		3%
County	Gender	Age	Harris Interactive		Census 2000 Data	
			Percent in		Percent in	
			County	All 8-Counties	County	All 8-Counties
Carver	Male	18-30	60%		18-29	13%
Carver	Male	31-40	15%		30-39	19%
Carver	Male	41-50	6%		40-49	18%
Carver	Male	51-60	3%		50-59	10%
Carver	Male	Over 60	1%		60+	9%
Carver	Male	Under 18	15%		under 18	32%
Carver	Male	Unknown	0%			
Percent of Males in all 8-counties				19%		3%
Chisago	Female	18-30	28%		18-29	13%
Chisago	Female	31-40	20%		30-39	18%
Chisago	Female	41-50	19%		40-49	16%
Chisago	Female	51-60	12%		50-59	10%
Chisago	Female	Over 60	3%		60+	14%
Chisago	Female	Under 18	18%		under 18	29%
Chisago	Female	Unknown	1%			
Percent of Females in all 8-counties				2%		1%
Chisago	Male	18-30	37%		18-29	13%
Chisago	Male	31-40	20%		30-39	18%
Chisago	Male	41-50	17%		40-49	16%
Chisago	Male	51-60	10%		50-59	10%
Chisago	Male	Over 60	5%		60+	12%
Chisago	Male	Under 18	11%		under 18	31%
Percent of Males in all 8-counties				1%		2%
Dakota	Female	18-30	33%		18-29	15%
Dakota	Female	31-40	20%		30-39	18%
Dakota	Female	41-50	18%		40-49	17%
Dakota	Female	51-60	12%		50-59	11%
Dakota	Female	Over 60	4%		60+	12%
Dakota	Female	Under 18	12%		under 18	28%
Dakota	Female	Unknown	1%			
Percent of Females in all 8-counties				13%		13%
Dakota	Male	18-30	30%		18-29	15%
Dakota	Male	31-40	20%		30-39	18%
Dakota	Male	41-50	20%		40-49	17%
Dakota	Male	51-60	14%		50-59	11%
Dakota	Male	Over 60	7%		60+	9%
Dakota	Male	Under 18	7%		under 18	30%
Dakota	Male	Unknown	2%			
Percent of Males in all 8-counties				11%		13%
Hennepin	Female	18-30	35%		18-29	17%
Hennepin	Female	31-40	19%		30-39	17%
Hennepin	Female	41-50	18%		40-49	16%
Hennepin	Female	51-60	11%		50-59	11%
Hennepin	Female	Over 60	5%		60+	16%

Hennepin	Female	Under 18	12%		under 18	23%
Hennepin	Female	Unknown	1%			
Percent of Females in all 8-counties				40%		42%
County	Gender	Age	Harris Interactive		Census 2000 Data	
			Percent in		Percent in	
			County	All 8-Counties	County	All 8-Counties
Hennepin	Male	18-30	32%		18-29	18%
Hennepin	Male	31-40	23%		30-39	18%
Hennepin	Male	41-50	18%		40-49	17%
Hennepin	Male	51-60	13%		50-59	11%
Hennepin	Male	Over 60	7%		60+	12%
Hennepin	Male	Under 18	6%		under 18	25%
Hennepin	Male	Unknown	1%			
Percent of Males in all 8-counties				37%		42%
Ramsey	Female	18-30	39%		18-29	19%
Ramsey	Female	31-40	18%		30-39	15%
Ramsey	Female	41-50	17%		40-49	15%
Ramsey	Female	51-60	11%		50-59	10%
Ramsey	Female	Over 60	4%		60+	17%
Ramsey	Female	Under 18	11%		under 18	24%
Ramsey	Female	Unknown	1%			
Percent of Females in all 8-counties				19%		19%
Ramsey	Male	18-30	36%		18-29	19%
Ramsey	Male	31-40	20%		30-39	16%
Ramsey	Male	41-50	18%		40-49	15%
Ramsey	Male	51-60	12%		50-59	10%
Ramsey	Male	Over 60	6%		60+	12%
Ramsey	Male	Under 18	7%		under 18	27%
Ramsey	Male	Unknown	1%			
Percent of Males in all 8-counties				17%		19%
Scott	Female	18-30	31%		18-29	14%
Scott	Female	31-40	19%		30-39	21%
Scott	Female	41-50	18%		40-49	16%
Scott	Female	51-60	10%		50-59	9%
Scott	Female	Over 60	2%		60+	10%
Scott	Female	Under 18	18%		under 18	31%
Scott	Female	Unknown	2%			
Percent of Females in all 8-counties				3%		3%
Scott	Male	18-30	31%		18-29	13%
Scott	Male	31-40	18%		30-39	20%
Scott	Male	41-50	23%		40-49	17%
Scott	Male	51-60	14%		50-59	10%
Scott	Male	Over 60	6%		60+	8%
Scott	Male	Under 18	7%		under 18	32%
Scott	Male	Unknown	1%			
Percent of Males in all 8-counties				2%		3%
Washington	Female	18-30	31%		18-29	12%
Washington	Female	31-40	18%		30-39	18%
Washington	Female	41-50	20%		40-49	18%

Washington	Female	51-60	12%		50-59	12%
Washington	Female	Over 60	4%		60+	12%
Washington	Female	Under 18	15%		under 18	29%
Washington	Female	Unknown	0%			
Percent of Females in all 8-counties				6%		7%

County	Gender	Age	Harris Interactive		Census 2000 Data	
			Percent in		Percent in	
			County	All 8-Counties	County	All 8-Counties
Washington	Male	18-30	34%		18-29	13%
Washington	Male	31-40	15%		30-39	17%
Washington	Male	41-50	21%		40-49	18%
Washington	Male	51-60	14%		50-59	12%
Washington	Male	Over 60	7%		60+	10%
Washington	Male	Under 18	8%		under 18	30%
Washington	Male	Unknown	1%			
Percent of Males in all 8-counties				5%		8%
Total Male						
Total Female						

Panel demographic information also is available for education and household income.